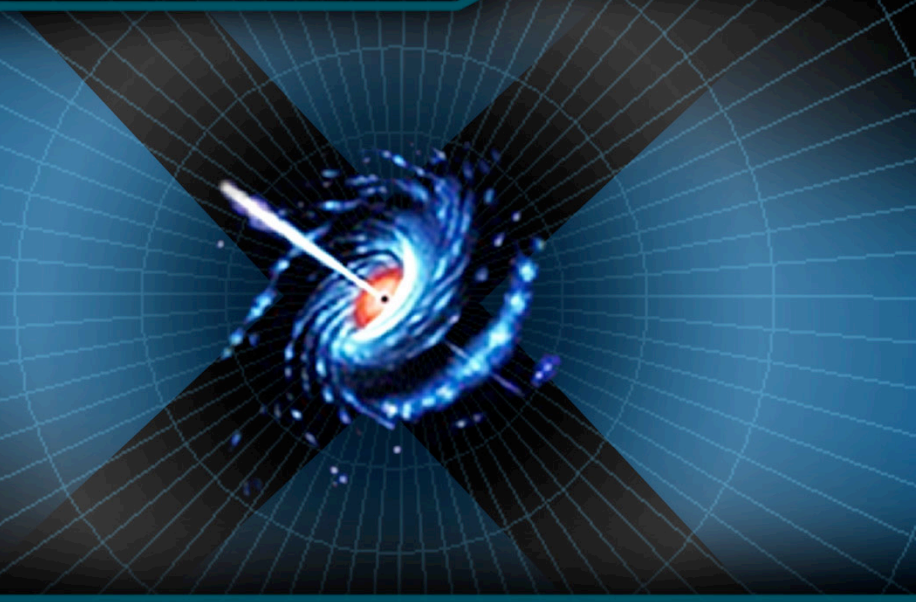
*Constellation-X Facility Science Team Meeting (FST) — February 21/22, 2008*

Constellation-X

The Constellation X-ray Mission



# Facility Science Team Panels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Goddard Space Flight Center

## Topics covered : Constellation-X FST Science Panels

- Panel restructuring process
- Panel topics and panel chairs
- Charge to the panels
- Logistics/Boundary Conditions

# Panel Restructuring Process

- During Fall 2007 panels re-opened to aid in preparing for the decadal survey (emails sent to high-energy astrophysics community lists)
- More than 120 people responded from >55 institutions including ~13 foreign institutions.
- These 120+ people have been organized into 14 panels: 5 Galactic, 8 extragalactic and one multidisciplinary panel on “Plasma Diagnostics and Atomic Astrophysics”
- An introductory message with a ‘charge to the panels’ was emailed out on 12/20/07
- A telecon with the panel chairs was held January 4, 2008 to discuss the process and prepare for this FST meeting
- Each panel chair has been organizing telecons and/or email exchanges over the last 2 months and will present their work thus far and future plans at this meeting

# Science Panels - Inside the Galaxy

*Note focus is on science themes/topics rather than target type*

| Panel Topic | Chair |
|---|---|
| Extreme States of Matter in Neutron Stars | Frits Paerels (Columbia) |
| Accretion Physics in Stellar Systems | Jon Miller (Michigan) |
| Production and Distribution of the Elements | John Hughes (Rutgers) |
| MHD Physics in Stellar Environments | Rachel Osten (U. of Md) |
| Solar System, Planet Formation & Evolution | Eric Feigelson (PSU) |

# Science Panels - Outside the Galaxy

| Panel Topic | Chair |
|---|---|
| Missing Baryons/WHIM; synergy with UV spectroscopy | Michael Shull (Colorado) |
| Census of Black Hole Accretion in the Universe | Nancy Levenson (U. of Kentucky) |
| Evolution of Large Scale Structure in the Universe | Steve Allen (KIPAC/Stanford) |
| Hot Baryons in Deep Potential Wells | Christine Jones (SAO) |
| Testing General Relativity and Measuring Black Hole Spin | Chris Reynolds (U. of Md) |
| Supernova/Stellar Feedback | David Strickland (JHU) |
| AGN Feedback: Outflows & Jets | Andy Fabian (Cambridge) |
| The high-z Universe, Re-ionization & Synergy with JWST "First Light" Science | Niel Brandt (PSU) |

# Science Panels - Cross-Panel Working Group on Diagnostics

| Panel Topic | Chair |
|---|---|
| Plasma Diagnostics and Atomic Astrophysics | Nancy Brickhouse (SAO) |

## Charge to the Panels

*The Science Panels are expected to review, update, and strengthen the Constellation-X science case in preparation for the upcoming decadal survey.*

# Why now? (beyond the decadal survey timing)

- Focus the science case back to being an "astrophysics observatory" rather than a Beyond Einstein mission
- The last science case overhaul was in late 2004/early 2005: the mission configuration has changed since then
  - XGS has higher spectral resolving power (R=1250 is the requirement)
  - XMS has a larger FOV (5' x 5' versus 2.5' x 2.5')
  - HXT has reduced collecting area (150 $cm^2$ at 40 keV)

# Work Flow for the Science Panels

1. Highlight one or more key science objectives within the topical area
   - Generate some text motivating why this is important
     - broad astrophysics perspective
     - why X-rays are unique or essential to the science
2. Identify possible measurements/observations with Con-X which can be evaluated through simulations.
3. Produce science materials for promoting Constellation-X:
   1. Brief, 'elevator-pitch' summaries including Power Point slides
   2. Detailed simulations demonstrating how the science goals map to the mission parameters.
   3. Written text (TBD): ApJ papers and/or conference proceedings are encouraged

# Work Flow for the Science Panels

*February 2008*

1. Highlight one or more key science objectives within the topical area
   - Generate some text motivating why this is important
     - broad astrophysics perspective
     - why X-rays are unique or essential to the science

*Spring 2008*

2. Identify possible measurements/observations with Con-X which can be evaluated through simulations.

3. Produce science materials for promoting Constellation-X:

*Finish by August 2008*

1. Brief, 'elevator-pitch' summaries including Power Point slides
2. Detailed simulations demonstrating how the science goals map to the mission parameters.

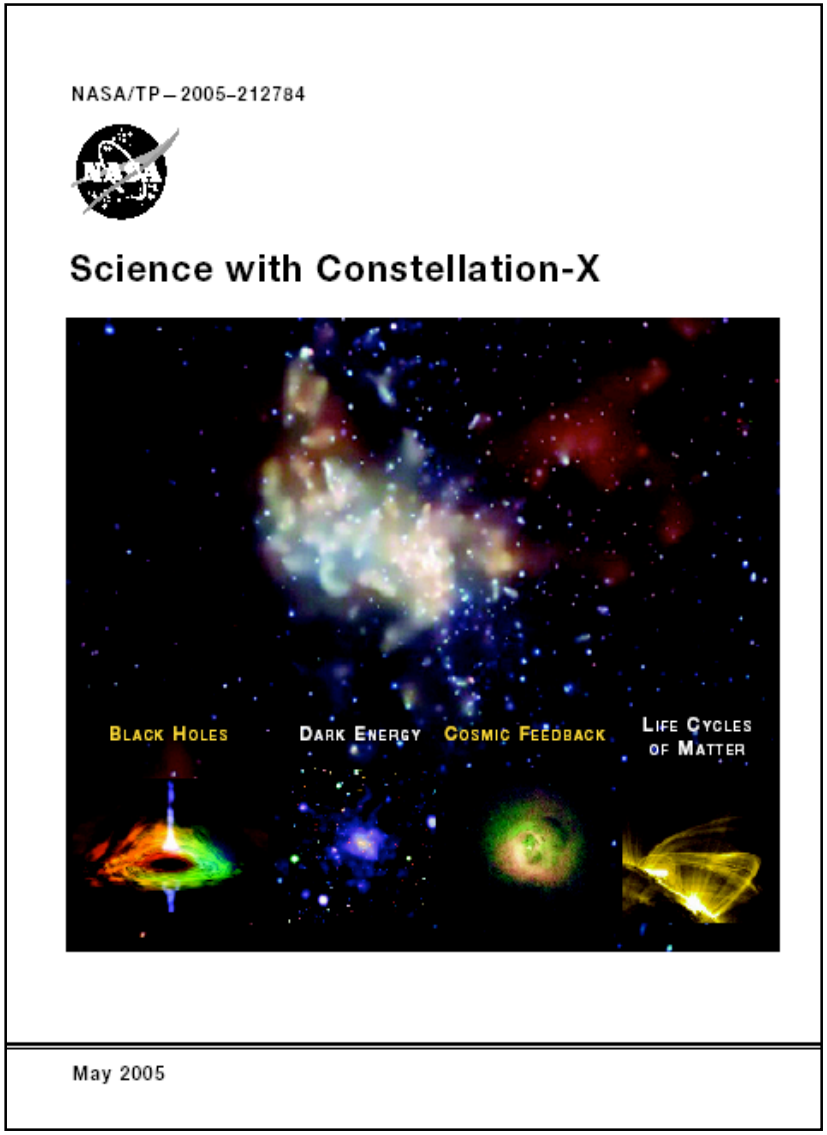
*Fall 2008*

3. Written text (TBD): ApJ papers and/or conference proceedings are encouraged

# Logistics/Boundary Conditions

- **There is a new email address that reaches all three of Randall, Mike and Ann: conx-observer@lists.nasa.gov**
- **Mission parameters:**
  - Mission cost and programmatic risk are expected to be factors in the decadal survey process.
  - ANSWER THIS QUESTION:
    What science can be done with the mission as described?
    (for now, imagine you are writing proposals, not designing the mission)
  - For science simulations use the parameters as defined for the Atlas V launch vehicle configuration : the latest response matrices are the FEB 2008 versions at constellation.gsfc.nasa.gov
  - Also please use the new simx simulator (R. Smith's talk, NEXT)

# Thank you!




- We hope to be producing great new products this fall based on your hard work.
- Thank you VERY much for taking the time to participate in the Con-X FST Science Panels

# Key Performance Requirements

| | |
|---|---|
| **Effective Area:** | **15,000 $cm^2$ @1.25 keV**<br>**6,000 $cm^2$ @6 keV**<br>**150 $cm^2$ @40 keV** |
| **Bandpass:** | **0.3 – 40 keV** |
| **Spectral Resolution:** | **1250 @0.3 – 1 keV**<br>**2400 @6 keV** |
| **Angular Resolution** | **15 arcsec 0.3 – 7 keV**<br>**30 arcsec 7.0 – 40 keV** |
| **Field of View** | **5 x 5 arcmin** |

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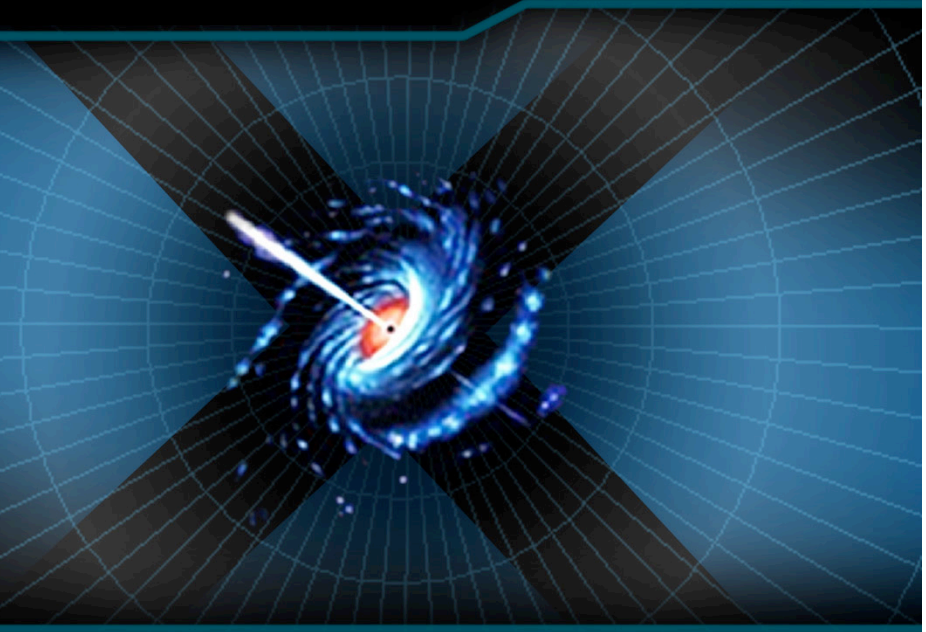


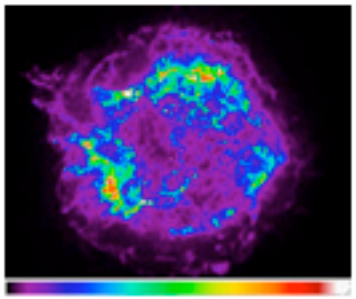
# simx:
## The Constellation-X Event Simulator

*Randall Smith*

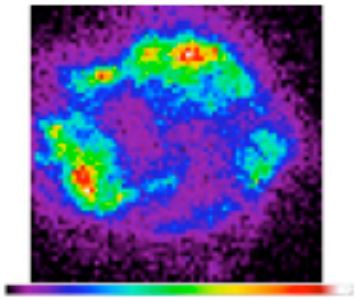
*NASA/GSFC & JHU*

Goddard Space Flight Center

# http://lheawww.gsfc.nasa.gov/users/rsmith/simx/index.html



**simx: A Constellation-X Event Simulator**



[Download simx](#) [Install simx](#) [Run simx](#)

**Downloading simx**

Click to download the tarball for simx. The current version is 0.2. The model psf is based on the simulated performance on-axis at 6.0 keV; no variation with energy or off-axis position is included. Energy resolution is based on the current response matrix. **Simx** is not particularly fast; we are working

**Installing simx**

**simx models the SXT PSF and XMS response, generating OGIP-standard event files**

## Installation

- Download simx from

  http://lheawww.gsfc.nasa.gov/users/rsmith/simx/

- Install via: (requires c compiler)

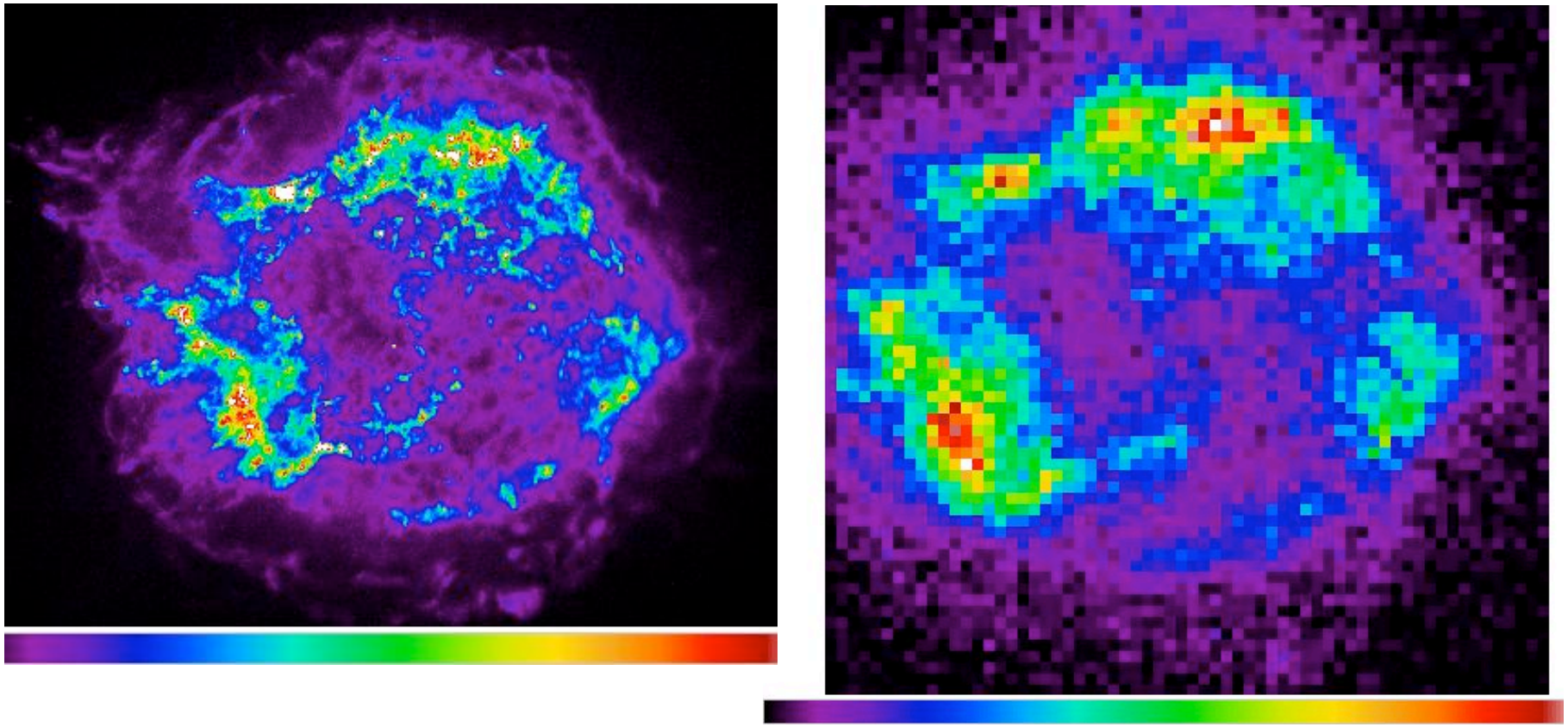
```
unix% tar -zxf simx-0.2.tar.gz
unix% cd simx-0.2
unix% ./configure
unix% make
unix% make install
```

- Tested on OS X, various flavors of Linux, and Solaris

## Running simx

- Detailed instructions in the 'doc/' directory list how to install and run simx.
- Sample run:
  - unix% pset simx OutputFileName=MyRun
  - unix% pset simx Exposure=100000
  - unix% pset simx SourceFlux=5e-11
  - unix% pset simx SourceImageType=Image
  - unix% pset simx SourceImageFile=a2029_img.fits
  - unix% pset simx SourceSpectrumType=spec.dat
  - unix% pset simx SourceSpectrumTpe=XSPEC_Fiel
  - unix% simx
- Output is MyRun_evt.fits, usable with ds9, xselect (with some assistance) or dmextract

# Sample Output



Cas A seen with Chandra and Con-X

## simx Features and Plans

- Uses either point source or image.
  - Goal to include a 'photon-list' input including both position and energy for each photon.
- SXT PSF based on P. Reid simulation on-axis at 6 keV, runs to 100" at maximum.
  - Goal to include position & energy-dependent PSF
- For bright sources, simx estimates deadtime at runtime.
  - Goal to flag 'degraded' events in event files.

## Possible Features

- Include vignetting model
- Include background terms from:
  - Instrumental/Cosmic Ray effects (Non-X-ray Bgd)
  - Cosmic X-ray Background
  - Solar-wind Charge Exchange effects
- Modeling XMS pixel differences; central 2.5' pixels may have higher resolution than outer pixels.
- Web-based version of simx (note that input and output files can be large)
- Other suggestions?

## Conclusions

- Available (currently) at http://lheawww.gsfc.nasa.gov/users/rsmith/simx
- Will soon move to the main Con-X website.
- Although basic, simx is adequate to determine how well a point source can be extracted from diffuse emission or other sources, or to see how well a radial profile can be measured.
- Contact Randall.K.Smith@nasa.gov with suggestions for improvements or bug reports...